3

POPULATION AND WATER-RELATED TRENDS AND PROJECTIONS

DEMOGRAPHICS AND ECONOMIC TRENDS AND PROJECTIONS

Approximately seven percent of Utah's population resides in the three Bear River Basin counties of Rich, Cache and Box Elder. The Utah portion of the Basin has a current population of 136,097 (2000 US Census), which is projected to increase to 203,705 by 2020 and to 297,597 by 2050. This is a total increase of nearly 50 percent or just over 2 percent per year over the next 20 years, and a total increase of 119 percent or approximately 1.6 percent annually over the next 50 years.

During the past ten years, the population projections for Utah's cities and counties have been modified several times to reflect the state's ever-changing growth trends. The Bear River Basin's actual population increase during the past eight years has exceeded the Governor's Office of Planning and Budget (GOPB) projections used in the 1992 Bear River Basin Plan. At that time, Cache County's 1990 population of 70,183 was projected to increase to 77,900 by 2000 and 107,200 by 2020. The 2000 U.S. Census put Cache County's population at 91,391. At the present time the GOPB's projected population for Cache County for 2020 is 137,966 and 203,285 by 2050. Likewise, Box Elder County's 1990 population was projected to increase from a population of 36,485 in 1990 to 40,500 in 2000 and 46,300 in 2020. The 2000 U.S. Census put Box Elder County's population at 42,745. At the present time Box Elder County is projected to grow to a population of 63,388 by 2020 and to 91,526 by 2050. Population estimates for Rich County have the current population of 1,961 and a projected increase to 2,351 by 2020 and to 2,786 by 2050.

Current GOPB population estimates and projected population figures for the basin's towns and cities are given in Table 7. The population projections for each of the basin's three populated counties are graphically depicted in Figure 7. The principal cities in the basin and their 2000 population estimates include Logan (42,670); Brigham City (17,411); Smithfield (7,261); North Logan (6,163); Hyrum (6,316); and Tremonton (5,592). (See Table 7)

Table 8 compares the results of the most recent economic survey (1997) of the basin with the 1987 economic survey used in the 1992 Bear River Basin Plan. No significant changes occurred in the past decade, but some trends emerged. With a few exceptions, most industries have shown growth in the past decade. However, manufacturing accounted for nearly half the basin's personal income in 1987, but has dropped to about 40 percent in the past ten years, while the Service, Retail Trade, and Transportation and Utilities sectors now constitute a larger part of the basin's economy. Agriculture and agricultural-related services remain at about four percent of the basin's total economy.

Figure 7
Population Trends and Projections

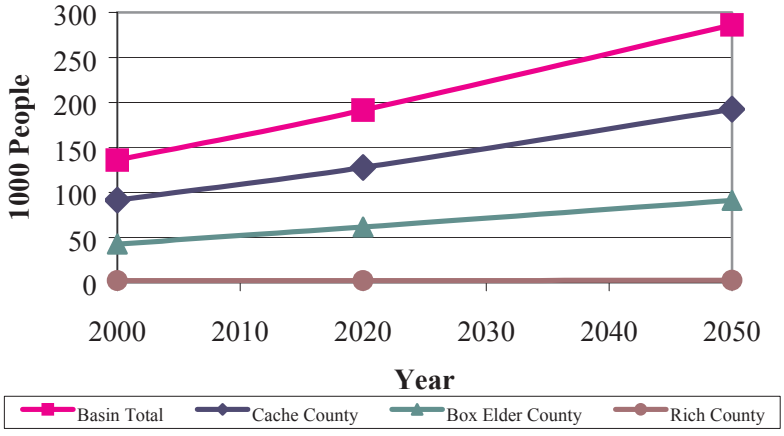


TABLE 7
POPULATION PROJECTIONS
Bear River Basin

Cities/Towns	Water Conservation			
Box Elder County	**Plan**	**2000[1]**	**2020[2]**	**2050[2]**
Bear River City	N/A	750	1,112	1,606
Brigham City*	Yes	17,411	25,821	37,281
Corinne*	N/A	621	921	1,330
Deweyville	N/A	278	412	595
Elwood	N/A	678	1,005	1,452
Fielding	N/A	448	664	959
Garland*	Yes	1,943	2,881	4,160
Honeyville*	N/A	1,214	1,800	2,599
Howell Town	N/A	221	328	473
Mantua	N/A	791	1,1173	1,694
Perry *	N/A	2,383	3,534	5,103
Plymouth	N/A	328	486	702
Portage	N/A	257	381	550
Snowville	N/A	177	262	379
Tremonton*	Yes	5,592	8,293	11,974
Willard*	Yes	1,630	2,417	3,490
Total for Incorporated Cities and Towns		**34,722**	**51,490**	**74,347**
Balance of the County		**8,023**	**11,898**	**17,179**
Box Elder County Total		**42,745**	**63,388**	**91,526**
Cache County				
Amalga	N/A	427	587	950
Clarkston	N/A	688	826	1,530
Cornish	N/A	259	257	576
Hyde Park*	Yes	2,955	3,787	6,573
Hyrum*	Yes	6,316	8,457	14,049
Lewiston	No	1,877	2,457	4,175
Logan*	Yes	42,670	59,587	87,166
Mendon*	N/A	898	1,782	1,997
Millville*	N/A	1,507	1,973	3,352
Newton	N/A	699	1,045	1,555
Nibley*	Yes	2,045	4,238	4,549
North Logan*	Yes	6,163	9,043	12,555
Paradise	N/A	759	1,093	1,688
Providence*	Yes	4,377	13,512	17,888
Richmond*	Yes	2,051	2,592	4,562
River Heights	Yes	1,496	1,657	3,328
Smithfield*	No	7,261	12,601	16,899
Trenton	N/A	449	595	999
Wellsville*	Yes	2,728	3,574	6,068
Total for Incorporated Cities and Towns		**85,625**	**129,643**	**190,459**
Balance of the County		**5,766**	**8,323**	**12,826**
Cache County Total		**91,391**	**137,966**	**203,285**
Rich County				
Garden City*	Yes	357	428	507
Laketown	N/A	188	225	267
Randolph*	N/A	483	579	686
Woodruff	N/A	194	233	276
Balance of the County		**739**	**886**	**1,050**
Rich County Totals		**1,961**	**2,351**	**2,786**
Basin Totals		**136,097**	**203,705**	**297,597**

* Incorporated Cities and Towns N/A: Not Applicable (less than 500 connections)
Source: 1) U.S. Census Bureau, ''National Census 2000''
2) ''2003 Baseline, UPED Model System,'' Governor's Office of Planning and Budget

New homes adjacent farm land west of Tremonton

LAND USE

Land-use data for the Utah portion of the basin, collected in 2003, is presented in Table 9. The table gives a county-by-county summary of the basin's irrigated croplands by crop for 2003. Grain accounted for 16 percent of the county's total irrigated lands, while alfalfa accounted for 30 percent. The 2003 land-use survey identified 298,896 acres of irrigated ground and 152,983 acres of non-cropland agricultural lands, including idle and fallow ground. A total of 451,879 acres of agricultural lands were identified.

WATER USE TRENDS AND PROJECTIONS

Agricultural use continues to be the major use of water in the Bear River Basin. During the past few decades, heavily populated portions of the state have experienced declining agricultural use corresponding to an increasing municipal and industrial (M&I) use. However, in the Bear River Basin the conversion of agricultural land to urban and the increasing use of water for M&I purposes has not resulted in reduced agricultural water use. The abundant supply of water in the basin has meant that it has not been necessary to convert agricultural water supplies to M&I uses. The conversion of agricultural land to urban has resulted in a net loss of dry-farm land but not in a loss of irrigated acreage. It is unlikely that this trend will be reversed any time soon.

Drinking Water

Significant population growth is projected throughout the basin during the next 20 years. However, most of the basin's municipalities have existing water supplies that are sufficient to meet the projected future demand. Although existing M&I water supplies appear adequate throughout much of the Bear River Basin, some systems currently have or will have problems in the near future. Some communities, such as Logan and Nibley in Cache County and Tremonton, North Garland and West Corinne in Box Elder County, are already operating at or near the limits of their reliable system/source

TABLE 8

Personal Income and Earnings (Million $)[a]

	Box Elder		Cache		Rich		Total			
Industry	1987	1997	1987	1997	1987	1997	1987	%	1997	%
Manufacturing	333	433	126	292	[b]	0.2	459	49%	726	41%
Government	32	58	123	226	2.5	4.5	158	17%	289	16%
Services	29	59	78	216	0.7	2.8	108	11%	277	16%
Retail Trade	24	62	38	97	0.4	1.2	62	7%	159	9%
Construction	19	33	36	73	0.3	0.7	55	6%	106	6%
Agriculture and Ag Services	18	32	18	30	4.2	3.4	40	4%	65	4%
Transportation and Utilities	7	22	16	41	0.5	0.3	24	2%	63	4%
FIRE[c]	5	11	13	27	[b]	[b]	18	2%	37	2%
Wholesale Trade	8	13	8	23	[b]	[b]	16	2%	35	2%
Mining	0	1	0	0	0.4	0.7	1	0%	2	0%
Total	475	724	456	1,025	9.0	13.8	940	100%	1,762	100%

[a] Source: *Utah Economic and Business Review* Volume 59 Numbers 3 and 4 March/April 1999
[b] Not shown to avoid disclosure of confidential information
[c] Financial, Insurance, and Real Estate

TABLE 9
Irrigated and Non-Irrigated (Dry) Agricultural Ground by Crop Type
Utah portion of the Bear River Basin

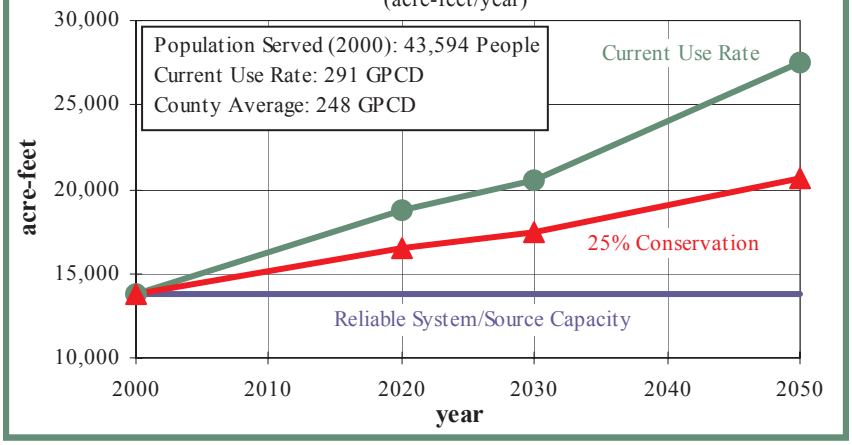
Crop	(Acres, by County) Box Elder	Cache	Rich	Summit	Total
Irrigated Cropland					
Alfalfa	28,057	52,922	9,019	0	89,998
Grain	26,316	19,958	1,905	0	48,179
Corn	13,374	7,259	11	0	20,644
Orchards/Fruit	1,157	38	0	0	1,195
Onions	1,223	0	0	0	1,223
Vegetables	286	113	0	0	399
Potatoes	0	46	0	0	46
Berries	0	0	52	0	52
Beans	0	10	0	0	10
Other Horticulture	59	101	0	0	160
Sorghum	2,235	960	0	0	3,195
Pasture	14,303	16,055	14,752	3,294	43,824
Sub-Irrigated Pasture	18,971	9,348	15,038	467	69,011
Grass/Hay	5,329	5,387	29,884	0	40,600
Sub-irrigated Grass/Hay	0	71	32	0	103
Grass Turf	682	182	0	0	864
Total Irrigated Cropland	**111,992**	**112,450**	**70,693**	**3,761**	**298,896**
Non-Irrigated Agricultural Land					
Alfalfa	1,603	6,883	641	0	9,127
Grains/Beans/Seeds	15,297	21,894	15,408	0	52,599
Pasture	14,676	5,636	13,491	1,406	35,209
Safflower	494	5,845	0	0	6,339
Fallow	7,021	6,126	138	0	13,285
Idle	14,381	20,317	1,567	159	36,424
Total Non-Irrigated Land	**53,472**	**66,701**	**31,245**	**1,565**	**152,983**
Total Agricultural Land	**165,464**	**179,151**	**101,938**	**5,326**	**451,879**

Source: *Water Related Land-use Inventories*, Bear River Basin (unpublished), Utah Water Resources, (2003 data)
Note: This table does not include irrigated lands in Idaho nor irrigated ground within the boundaries of the Bear River Migratory Bird Refuge.

capacity. Other communities, such as Garland and Brigham City in Box Elder County and Lewiston, Amalga and Newton in Cache County, will reach the limits of their reliable system/source capacity by 2020. Supply vs. demand graphs (Figures 8 through 13) have been included here to show the inter-relationships between each town's existing system's reliable system/source capacity (the blue line) and the projected demand for the next 50 years. Each figure includes a pair of future demand lines. The green line shows the community's projected water needs based upon its current use rate, while the red line shows the reduction in demand if 25 percent conservation is achieved by 2050. Similar figures have been prepared for each of the basin's municipalities and are included in the appendix.

New Homes in Cache Valley

Figure 8
Logan City
Existing Supply vs Demand
(acre-feet/year)



Reliable system/source capacity is a term used here to quantify how much water can be delivered by the existing community water system. As the term implies, delivery limits may be a result of inadequate infrastructure (system) or insufficient supply (source). For some communities, improving system capacity may simply mean replacing a pump, whereas for another community it could entail locating and developing a new water source, building a larger storage tank, and enlarging mainline pipes. This report will not go into the detail of identifying the specifics of each system's limitations, nor identify possible remedies. The intent here is to compare each community water system's existing reliable system/source capacity to its projected future demand and thereby show when problems will likely arise. It is important to understand that the reliable system/source capacity is a theoretical number based upon supplying adequate flow during periods of peak demand. Consequently, it is possible for a system to deliver more total water than the calculated reliable system/source capacity. When this happens the system will function adequately much of the time. But during periods of peak demand, usually in the morning or early evening during the summer months, the system pressure will drop, resulting in delivery problems. Such reductions in system pressure have serious implications including potential water contamination and reduced fire fighting capabilities.

Many communities in the state have initiated water conservation plans in an effort to reduce the rate of consumption of M&I water supplies. The Division of Water Resources has encouraged communities to develop water conservation plans, and has required the existence of such a plan whenever state money has been used to assist in project development. Since water supplies are plentiful throughout most of the basin, often there seems to be little incentive for communities to develop and adhere to a water conservation program. However, there is considerable incentive when one considers the infrastructure needs and capital expense associated with increasing system capacity to meet future demands. It is hoped that communities will recognize the potential for water conservation efforts not only to stretch existing supplies but also to delay the need for expensive capital improvements.

As can be seen in Figure 8, Logan City's water system is currently operating at its reliable system/source capacity. This means there is already a need for some form of infrastructure improvement or additional water source. Logan's current total

Figure 9
Nibley
Existing Supply vs Demand
(acre-feet/year)

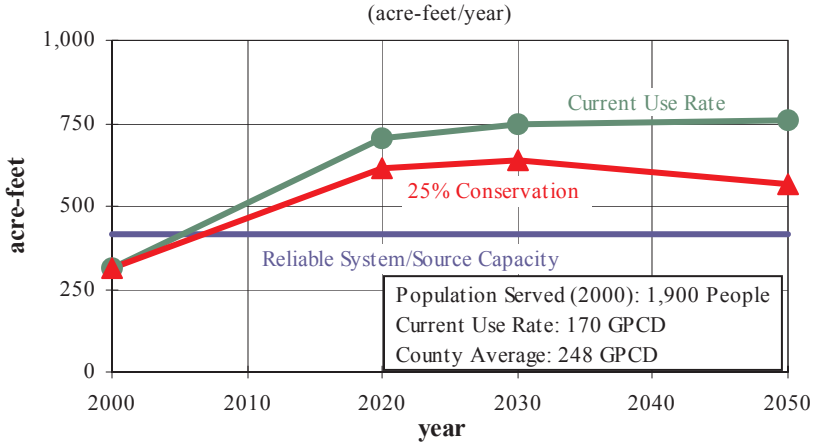
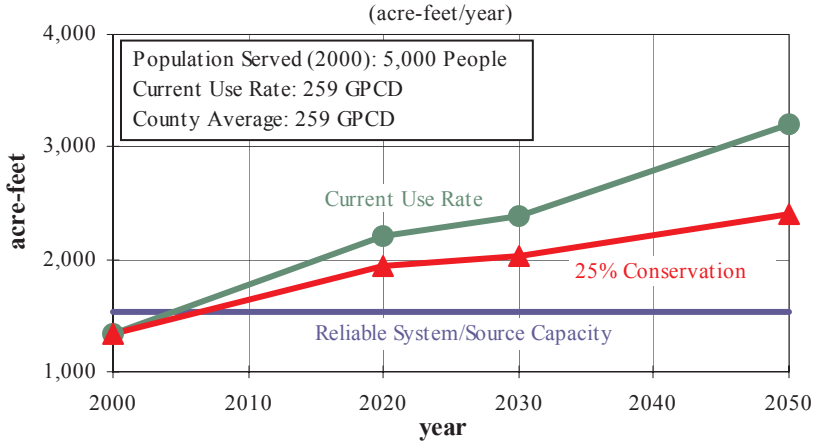


Figure 10
Tremonton
Existing Supply vs Demand
(acre-feet/year)



M&I use is 291 gallons per capita per day (GPCD), a rate which is about 17 percent higher than the county-wide average of 249 GPCD. The Current Use Rate line shows what Logan's future water needs will be if the residents continue to use water at the current rate of 291 GPCD. For comparison the 25 percent conservation line shows how future demand will be impacted if Logan's residents can achieve 25 percent water use reduction by the year 2050.

The town of Nibley (current population 1,900) is presently operating near the reliable system/source capacity of the town's water system (See Figure 9). At the present time, Nibley is only using 170 GPCD, approximately 68 percent of the countywide average. In addition to being near the limits of its reliable system/source capacity, Nibley is also faced with the probability of exceeding its existing water supply within the next 20 years. From Figure 9 it can be seen that 25 percent water conservation will do little to address either of these immediate problems for the town. At the present time Nibley is in need of additional water supplies and infrastructure improvements.

In Box Elder County, Tremonton's situation is almost identical to Logan's (Figure 10). The city's existing water system is operating near the limits of its reliable system/source capacity. Tremonton's total M&I use is currently 259 GPCD, within five percent of the countywide average of 249 GPCD.

North Garland (Figure 11) is currently using 283 GPCD, which is slightly higher than the countywide average. However, North Garland is currently operating at the limit of the system's reliable system source capacity.

Despite having adequate water supplies, many towns in the basin will reach or exceed the limits of their reliable system/source capacity within the next 20 years. For many of these towns, water conservation is a reasonable and economic means of delaying the inevitable cost of system improvements. Figure 12 and Figure 13 show two towns, Brigham City in Box Elder County and Lewiston in Cache County, which will reach the limits of their system's capacity around 2012 if water conservation efforts are not undertaken. As shown by the graphs, however, both of these towns could delay necessary infrastructure improvements to their systems a few years through water conservation efforts.

At its current total M&I per capita use rate (285 gallons per capita day), Brigham City will reach the

Figure 11
North Garland
Existing Supply vs Demand
(acre-feet/year)

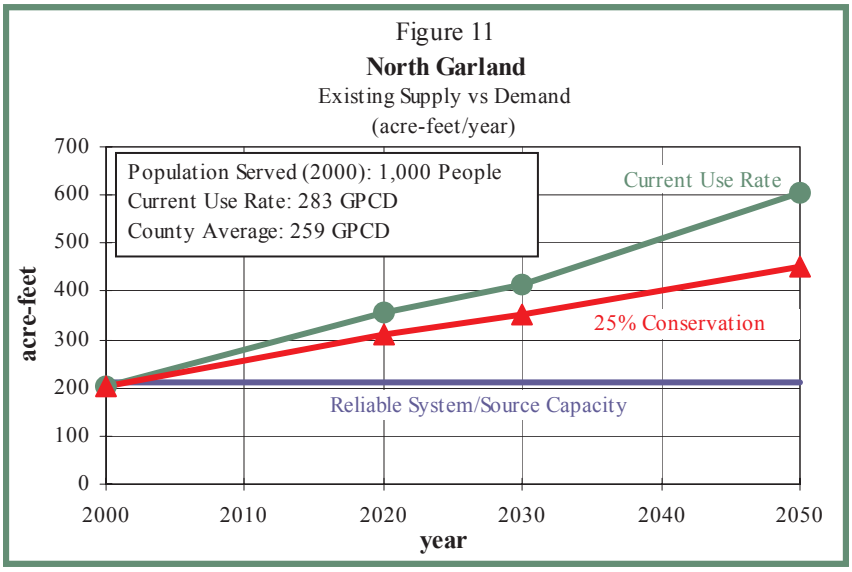
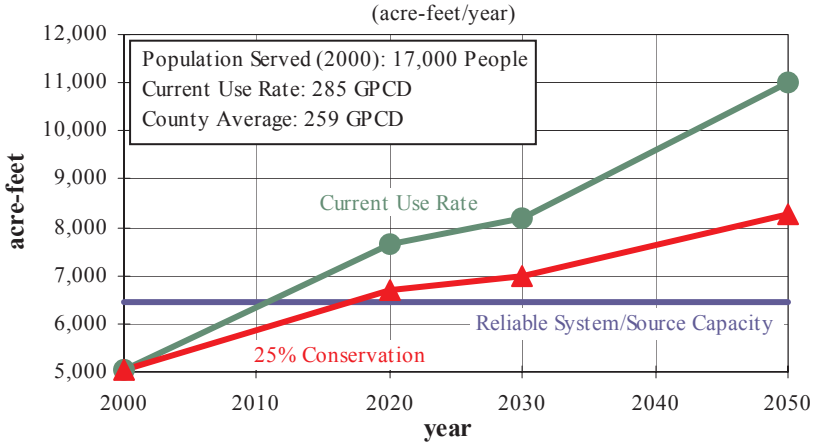


Figure 12
Brigham City
Existing Supply vs Demand
(acre-feet/year)



limits of its reliable system/source capacity around 2012 (See Figure 12). With the rapid growth rate projected for Brigham City, water conservation will only delay the need for system improvements a few short years.

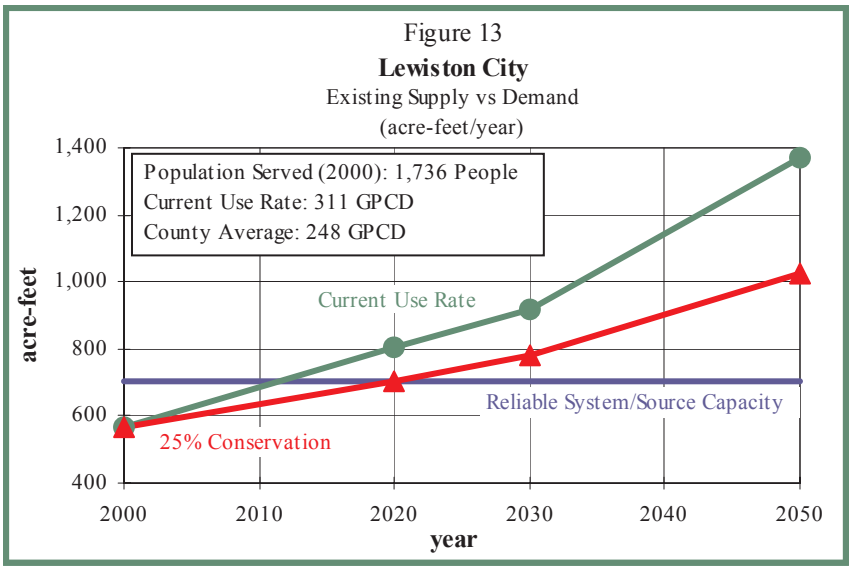
For Lewiston, with a current total M&I use rate of 311 gallons per capita-day, the system's reliable system/source capacity will be exceeded in about 2012. With water conservation that date can be moved back to about 2020. For Lewiston, as with Brigham City, the implication is that the life of the existing system could be prolonged by 8-10 years through conservation.

The impacts predicted by the supply vs. demand graphs are summarized for all communities in Table 10, which compares each water system's reliable system/source capacity to the community's predicted future water demand. Future water demands were calculated by multiplying the projected population, by the current use rate. The 25 percent conservation line assumes a water conservation reduction of 12.5 percent by 2020, and a 25 percent reduction by 2050. Through the use of color shaded cells Table 10 shows which communities are most likely to have problems with reliable system/source capacity over the next 50 years.

Table 10 shows that most communities in the basin have sufficient water supplies through the year 2020. In Box Elder County four communities will need to address system deficiencies by 2020. Through water conservation efforts alone one of these communities, Mantua, could reduce the impact of future demand enough to reduce or delay the need for infrastructure improvement beyond the year 2020. The four communities, Brigham City, North Garland, Tremonton, and West Corinne will face significant system deficiencies and will need to implement some system improvements in addition to any water conservation measures. These communities are all within the Bear River Water Conservancy District service area, and could obtain additional water through the district. Several more communities in Box Elder County will face system deficiencies by the year 2050. The communities of Brigham City, Elwood, Garland, Harper Ward and Corinne could meet their needs through 2050 through water conservation alone.

In Cache County several communities (Amalga, Lewiston, Logan, Millville, Newton, Nibley, and Smithfield) will face water system deficiencies by 2020. By 2050 several more Cache County communities (Benson, Clarkston, Cornish, Hyrum,

Figure 13
Lewiston City
Existing Supply vs Demand
(acre-feet/year)



Lewiston, Paradise and Providence) will also face delivery problems. Although all of these communities will benefit from water conservation, most will have to address their future water needs with more than just water conservation. For many communities throughout the basin, the big problem is not actually water supply but some deficiency in their water delivery system. For Logan, Nibley, Paradise, Cornish, Tremonton, North Garland and West Corinne the problems exist now. These systems are already operating at the limits of their reliable system/source capacity. For these communities, infrastructure improvements are already needed. For other communities like Lewiston, Millville, Clarkston, Amalga, Smithfield, and Newton, planning efforts now and water conservation strategies implemented over the next 20 years may postpone the need for expensive infra-

TABLE 10
PROJECTED CULINARY M&I DEMAND AND SUPPLY FOR PUBLIC COMMUNITY WATER SYSTEMS
Bear River Basin (Box Elder County)
(acre-feet /year)

Name	Reliable System/ Source Capacity	2020			2050		
		Population	Demand*	Surplus Deficit ()	Population	Demand*	Surplus Deficit ()
Box Elder County							
Acme Water Co. (Bear River City)	391	1,112	253	138	1,606	313	78
Beaver Dam Water Co.	163	61	17	146	61	14	149
Bothwell Cemetery and Water Corp.	174	529	169	5	562	177	(3)
Brigham City Municipal Water	6,473	25,821	6,678	(205)	37,281	8,265	(1,792)
Cedar Ridge Subdivision	150	100	19	131	100	16	134
Coleman Mobile Home Court	17	48	10	7	48	9	8
Corinne City Corp.	235	921	115	120	1,330	142	93
Deweyville Municipal Water System	202	412	90	112	595	111	91
Elwood Town	384	1,005	260	124	1,452	322	62
Five C's Trailer Court	17	50	7	10	50	6	11
Garland City Corp.	908	2,881	672	236	4,160	832	76
Harper Ward*	100	150	17	83	150	17	83
Honeyville Municipal Water System	1,186	1,800	629	557	2,599	778	408
Hot Springs Trailer Court	25	110	14	11	110	12	13
Mantua Culinary Water System	323	1,173	280	43	1,694	346	(23)
Marble Hills Subdivision	142	136	29	113	136	25	117
Perry City Water System	1,394	3,534	666	728	5,103	825	569
Plymouth Town	397	486	106	291	702	132	265
Portage Municipal Water System	94	381	67	27	550	83	12
Riverside – North Garland Water *	212	1,933	312	(100)	3,262	451	(239)
South Willard Culinary Water	367	392	101	266	629	139	228
Sunset Park Water Co.	13	35	11	2	35	10	3
Thatcher-Penrose Service District*	553	926	184	369	1,137	194	359
Tremonton Culinary Water*	1,535	8,293	1,937	(402)	11,974	2,398	(863)
Ukon Water Co.*	200	1,031	127	73	1,411	150	50
West Corinne Water Co	967	1,852	1,165	(198)	2,274	1,226	(259)
Willard Municipal Water System	847	2,321	667	180	3,490	859	(12)
County Totals		**57,493**	**14,603**	**2,866**	**82,501**	**17,851**	**(382)**

Dark Green Surplus/Deficit Cell indicates that without conservation the existing Reliable System/Source Capacity will be inadequate.
Red Surplus/Deficit Cell indicates that even with conservation the existing Reliable System/Source Capacity will be inadequate.

* These communities also receive water from the Bear River Water Conservancy District

TABLE 10 (continued)

PROJECTED CULINARY M&I DEMAND AND SUPPLY

FOR PUBLIC COMMUNITY WATER SYSTEMS

Bear River Basin

(acre-feet /year)

Name	Reliable System/ Source Capacity[1]	2020			2050		
		Population	Demand*	Surplus Deficit ()	Population	Demand*	Surplus Deficit ()
Cache County							
Amalga Municipal Water System	559	587	649	(90)	950	900	(341)
Benson Water Culinary District	147	577	105	42	1,048	164	(17)
Clarkston Municipal Water System	471	826	387	84	1,530	615	(144)
Cornish Municipal Water System	99	257	85	14	576	162	(63)
Goaslind Spring Water Works Co.	401	60	11	390	60	9	392
High Creek Culinary Water System	64	85	19	45	85	16	48
Hyde Park Culinary Water System	1,244	3,787	467	777	6,573	695	549
Hyrum City Water System	4,771	8,457	2,703	2,068	14,049	3,848	923
Lewiston Culinary Water System	705	2,457	705	0	4,175	1,026	(321)
Logan City Water System	13,758	59,587	16,455	(2,697)	87,166	20,632	(6,874)
Mendon Culinary Water System	294	1,782	204	90	1,997	196	98
Millville City Water	454	1,973	390	64	3,352	568	(114)
Newton Town Water	158	1,045	171	(13)	1,555	218	(60)
Nibley City	406	4,238	617	(211)	4,549	567	(161)
North Logan Culinary System	2,986	9,043	1,275	1,711	12,555	1,517	1,469
Paradise Town	190	1,093	160	30	1,688	212	(22)
Providence City Corp. Water	3,748	13,512	2,972	776	17,888	3,373	375
Richmond City	919	2,592	448	471	4,562	676	243
River Heights City Water System	1,208	1,657	573	635	3,328	987	221
Smithfield Municipal Water System	2,311	12,601	2,052	259	16,899	2,359	(48)
South Cove Water Supply	182	73	19	163	202	16	166
Trenton City	577	595	96	481	999	138	439
Wellsville City	4,022	3,574	583	3,439	6,068	848	3,174
County Totals		**130,458**	**31,145**	**8,529**	**191,854**	**39,743**	**(69)**
Rich County							
Garden City Water System	771	428	418	353	507	424	347
Laketown City Water System	235	225	194	41	267	198	37
Mountain Meadow Park Imp. Dist.	325	120	14	311	139	14	311
Randolph City	276	579	280	(4)	686	284	(8)
Woodruff Culinary Water System	52	223	45	7	276	46	6
County Totals		**1,585**	**951**	**708**	**1,875**	**966**	**693**

Dark Green Surplus/Deficit Cell indicates that without conservation the existing Reliable System/Source capacity will be inadequate.

Red Surplus/Deficit Cell indicates that even with conservation the existing Reliable System/Source capacity will be inadequate.

*Calculated demand for 2020 and 2050 include 12½ percent and 25 percent conservation respectively.

1 Reliable system source capacity represents the volume of water, which when divided by the average annual per capita use, gives the population that can reliably be served by the existing system under peak day demand conditions.

Source: *2001 M&I Water Supply Bear River Report*, Utah Division of Water Resources, April, 2001.

structure improvements to the '20s and '30s.

In Rich County no communities appear to have a serious water system deficiency. Randolph is currently operating at the limits of its system's reliable system/source capacity. However, the city's current water-use rate is more than twice the county average. Water conservation efforts alone would resolve any delivery problems Randolph might face over the next 50 years.

Secondary Water

A secondary (or dual) water system supplies non-potable water for uses that do not require high quality water, principally for watering lawns and gardens. The major purpose of a secondary water system is to reduce the overall cost of water treatment by using cheaper untreated water where appropriate, and preserving higher quality water for domestic use. Secondary systems are most suitable for areas where it is economically feasible to construct a separate storage and distribution system in addition to the potable (drinking) water system. Installing secondary systems is generally more feasible in developing areas. This allows secondary lines to be placed at the same time as other infrastructure, greatly reducing costs and inconvenience to homeowners.

Although secondary systems free up higher quality water supplies for culinary uses, people tend to use more water with them than if they are watering lawns with the drinking water system. This is because secondary systems are not metered, so people pay a flat fee for as much water as they want rather than paying for what they actually use.

An economical meter is not yet available that can withstand the severe conditions of a secondary system. Secondary water is often laden with suspended grit and organic material, which wears away and clogs moving parts. Also, secondary systems are drained in the fall and left dry through the winter months. This results in a buildup of organic material, which hardens and impedes the free movement of the meter parts when the system is then refilled.

The Logan River above 1st Dam

Further research into the development of a meter, so that water users can be billed according to their use, is encouraged. Another solution that may work in some instances is the installation of filters to remove grit and organic material at the head of the systems. This would help reduce clogs and wear and tear on moving parts, but does not solve the problems associated with the draining of the system during the winter months.

In the Bear River Basin, the total secondary use, including commercial and institutional uses, is about 5,200 acre-feet per year (See Table 11). This represents about 13 percent of the basin's total residential water use. Percentage-wise the Bear River Basin has one of the lowest rates of secondary water use in the state.

TABLE 11
Secondary (Non-Potable) Water Use Within Public Community Systems
Bear River Basin

County	Residential Use (Ac-Ft/year)	Commercial Use (Ac-Ft/year)	Institutional Use (Ac-Ft/year)	Industrial/ Stockwater Use (Ac-Ft/year)	Total Secondary Use (Ac-Ft/year)
Box Elder	754	186	594	0	1,535
Cache	2,392	173	907	0	3,472
Rich	21	138	28	0	186
Total	**3,167**	**497**	**1,529**	**0**	**5,193**

Source: *Municipal & Industrial Water Supply Studies: Bear River Basin*, Utah Water Resources, 2001

Table 12 shows the current use rate of treated drinking water and untreated secondary water for each of the basin's communities.

Currently the statewide average municipal and industrial water use is 293 gallons per capita-day (GPCD). Including the secondary water use the Bear River Basin's average is virtually the same at 292 GPCD. These numbers include indoor and outdoor residential, commercial, institutional and industrial uses. These per capita use numbers vary widely from town to town and can be used as an indicator of where water conservation might be beneficial. However, the numbers cannot be used as the sole indicator of where water supplies are being wasted. The town of Amalga, for instance, has a total residential use of 1,144 GPCD which includes 880 GPCD of industrial water use, primarily at the

TABLE 12
Municipal and Industrial Water Use
Bear River Basin (Box Elder County)

Community	Service[1] Population (2000)	Culinary Water Use		Secondary Water Use (GPCD)		Total M & I Use (GPCD)
		(Ac-ft/yr)	(GPCD)	Residential	Other	
Box Elder County						
Acme Water Co. (Bear River City)	820	212.9	231.8	34	49	314.4
Beaver Dam Water System	61	18.7	273.7	0	0	273.7
Bothwell Cemetery and Water Corp.	400	116.6	260.2	37	28	325.2
Brigham City Water System	17,000	5,024.9	263.9	5	16	284.9
Cedar Ridge Subdivision	100	21.4	191.0	0	0	191.0
Coleman Mobile Home Court	48	3.8	70.7	93	47	210.2
Corinne City Water System	646	91.7	126.7	76	50	252.3
Deweyville City Water System	350	86.6	220.9	34	64	318.6
Elwood Town Water System	625	184.6	263.7	28	0	291.7
Five C's Mobile Home Park	50	6.5	116.0	0	0	116.0
Garland City Water System	1,680	448.2	238.2	7	6	251.5
Harper Ward Water System[2]	150	16.9	100.6	182	0	322.0
Honeyville City Water System	1,250	498.7	356.1	0	24	379.7
Hot Springs Trailer Court	110	13.7	110.7	0	11	121.8
Mantua Town Water System	708	193.3	243.7	3	8	254.4
Marble Hills Subdivision	136	32.1	210.7	0	0	210.7
Perry City Water System	2,000	431.3	192.5	74	6	272.9
Plymouth Town	400	100.0	223.2	0	0	223.2
Portage Town Water System	250	50.3	179.6	107	0	287.1
Riverside-North Garland Water System[2]	1,100	203.3	165.0	35	83	282.9
South Willard Water Company	264	73.1	247.2	18	0	265.1
Sunset Park Water Co.	35	8.8	224.4	0	0	224.4
Thatcher-Penrose Service District[2]	700	159.2	203.0	50	0	252.7
Tremonton City Water System[2]	5,000	1,334.7	238.3	0	20	258.7
Ukon Water Co.[2]	920	129.8	125.9	149	51	326.1
West Corinne Water Co.	1,345	967.1	641.9	14	2	657.6
Willard City Water System	1,535	503.6	292.9	10	4	306.9
County Totals	**37,683**	**10,931.8**	**259.0**	**18**	**18**	**295.4**

Source: *Municipal & Industrial Water Supply Studies: Bear River Basin*, Utah Water Resources, 2001.
GPCD - Gallons per Capita Day

1. Service population is reported by the water purveyor and may differ significantly from the 2000 census numbers shown in Table 8.
2. These communities also receive water from the Bear River Water Conservancy District.

TABLE 12 (continued)
Municipal and Industrial Water Use
Bear River Basin (Cache and Rich Counties)

Community	Service[1] Population (2000)	Culinary Water Use		Secondary Water Use (GPCD)		Total M & I Use (GPCD)
		(Ac-ft/yr)	(GPCD)	Residential	Other	
Cache County						
Amalga Municipal Water System[2]	410	518.4	1,128.7	16	0	1,144.8
Benson Water Improvement District	560	116.6	185.9	77	0	263.1
Clarkston Municipal Water System	670	359.1	478.5	0	0	478.5
Cornish Municipal Water System	250	94.3	336.7	11	21	368.8
Goaslind Spring Water Works Co.	60	6.2	92.2	89	0	181.5
High Creek Water System	85	26.4	277.3	11	0	287.8
Hyde Park Water System	3,000	423.1	125.9	56	8	190.1
Hyrum City Water System	6,185	2,258.5	326.0	110	14	450.2
Lewiston City Water System	1,736	568.9	292.5	14	4	310.8
Logan City Water System	43,594	13,757.7	281.7	0	10	291.3
Mendon City Water System	804	104.7	116.2	160	29	305.0
Millville City Water System	1,350	305.2	201.8	23	20	244.8
Newton Town Water System	690	129.3	167.3	111	34	312.2
Nibley City	1,900	316.0	148.5	22	0	170.4
North Logan City Water System	6,400	1,031.2	143.8	24	9	176.6
Paradise Town Water System	645	107.7	149.1	260	36	444.8
Providence City Water System	4,610	1,159.0	224.4	14	0	238.2
Richmond City Water System	1,938	383.1	176.5	67	18	261.5
River Heights City Water System	1,480	576.2	347.5	7	2	357.0
Riverside Culinary Water Co.	90	19.6	194.4	0	0	194.4
Smithfield City Water System	7,420	1,381.1	166.2	34	30	230.3
South Cove Water Works	73	11.9	145.5	73	49	267.8
Trenton City Water System	500	92.4	165.0	104	11	279.3
Wellsville City Water System	3,000	559.2	166.4	30	0	195.9
County Totals	**87,450**	**24,305.8**	**248.1**	**24**	**11**	**283.0**
Rich County						
Garden City Water System[3]	225	251.4	997.4	6	546	1,549.0
Laketown City Water System[3]	340	236.6	624.2	36	14	674.6
Mountain Meadow Imp. District	80	16.3	181.9	0	0	181.9
Randolph City	500	276.2	493.1	0	32	525.2
Woodruff Town Water System	140	43.1	274.8	29	26	329.0
County Totals	**1,285**	**823.6**	**572.2**	**17**	**111**	**700.5**
Basin Totals/Averages	**126,418**	**36,061.2**	**255.0**	**22**	**15**	**291.7**

Source: *Municipal & Industrial Water Supply Studies: Bear River Basin*, Utah Water Resources, 2001
GPCD - Gallons per Capita Day
1. Service population is reported by the water purveyor and may differ significantly from the population numbers shown in Table 7.
2. High per capita use includes commercial water use at the cheese factory.
3. High per capita use is a result of high influx of seasonal tourism

town's cheese factory. Garden City and Laketown also have high per capita water use. For both of these communities though, these high numbers are a result of a seasonal influx of temporary residents and tourist.

Agriculture

The 1986 land-use data used in the 1992 Bear River Basin Plan identified the basin's total cultivated ground as 420,000 acres. Of that total, 301,700 acres were irrigated and 118,300 acres were non-irrigated cropland. Land-use data collected in 1996 identified 306,390 acres of irrigated ground and 110,803 acres of non-irrigated agricultural ground for a total of 417,193 acres of cultivated ground.

Land use inventory data collected in 2003 put the current total irrigated acreage within the Utah portion of the Bear River Basin at 298,896 acres with 152,983 acres of non-irrigated lands for a total of 451,879 acres of agricultural ground. The data shows a basin-wide reduction in irrigated acres of less than one percent over the past seventeen years.

The 1992 Bear River Basin Plan also showed Bear River water was used to irrigate 60,000 acres in Wyoming and 190,000 acres in Idaho. No effort has been made in this update to evaluate how much ground is now irrigated in these states.

Table 13 compares the water-related land use data of 1986 with the data collected in 1996 and the land-use data collected most recently during the summer of 2003. Percentage-wise the biggest change (a 41.6 percent increase) in irrigated cropland has been in Summit County where just over 1,100 acres of additional surface- and sub-irrigated pastureland has been identified. The data also shows a reduction in irrigated cropland of 2,743 acres (3.7 percent) in Rich County.

In Cache County the irrigation cropland reduction of 7,364 acres (6.2 percent) over the past seventeen years corresponds well with the increased population of 35,000 persons. The implication for Cache County seems to be that population growth and urban development occurs hand-in-hand with agricultural reductions, as irrigated cropland is converted to housing lots along with commercial and industrial development.

Corinne Canal

In Box Elder County urban growth appears to have had a less significant impact upon existing agriculture. Although the data shows an increase of 6,195 acres (5.9 percent) over the past seventeen years, the increase is attributable to the identification of sub-surface irrigated pasture that was initially identified as dry pasture in the 1986 survey. In reality, surface irrigation in Box Elder County has remained fairly consistent through all three surveys.

TABLE 13
Irrigated Cropland by County
Bear River Basin

County	1986	1996	2003	Increase (%)
Summit	2,655	3,129	3,761	41.6
Rich	73,436	72,377	70,693	-3.7
Cache	119,814	119,772	112,450	-6.2
Box Elder	105,797	111,112	111,992	5.9
Basin Total	301,702	306,390	298,896	-0.9

Source: Bear River Basin Water Related Land Use Inventories, Division of Water Resources, January, 1991 & Unpublished 1996 and 2003 land-use data

Environment

The Bear River Basin has no regulated instream flow requirements. The hydro-power plant at Cutler Dam was relicensed by FERC in April of 1994, but the new license did not stipulate any instream flow requirement associated with the operation of the Reservoir. The re-licensing process for the Soda, Grace-Cove, and Oneida projects is currently underway and scheduled for completion in 2004.

Although the basin has no instream flow requirements, the larger streams have some flow present throughout the year. With the exception of small reaches of

the Blacksmith Fork, which are seasonally dewatered by hydroelectric developments, the entire length of Blacksmith Fork River and Logan River are Class I and/or Class II fisheries from their respective headwaters to the canyon mouths. With no significant upstream storage and few diversions, these streams are some of the highest quality trout fisheries in the state.

Bear River Migratory Bird Refuge

The Bear River Migratory Bird Refuge is located 15 miles west of Brigham City, Utah, and covers 74,000 acres of marshes, uplands and open water. Established in 1928 on the delta of the Bear River in the Great Salt Lake, the refuge attracts thousands of migratory ducks, swans, geese, shorebirds and other fowl. The site of the refuge has long been a popular stopping spot for migratory fowl. Botulism outbreaks at this location predate the existence of the bird refuge, which has suffered significant losses of birds to botulism in recent years. Botulism outbreaks typically occur in the late summer and early spring. The severity of the outbreaks appears to be influenced by the availability of water to flush the marsh system. The refuge's water right entitles it to a flow of 1,000 cfs up to a total use of 425,771 acre-feet per year. But mid-July through September flows in the river are often significantly less than 1,000 cfs. To mitigate this problem, the refuge has expressed interest in enlarging Hyrum Reservoir. Additional storage at Hyrum Reservoir would provide the refuge with late season flows that could be used to flush the ponds and hopefully reduce late summer botulism outbreaks.

Recreation

The Bear River Basin has numerous large reservoirs and streams that offer many water-related recreation opportunities. All the lakes and reservoirs are used for fishing, and some of the larger ones, such as Bear Lake, Hyrum, Newton and Mantua, are popular with boaters. The upper end of Cutler Reservoir is a marshland inhabited by waterfowl and navigable by canoe or a small motorboat.

Recreational water use continues to grow in the state. From 1959 to 1998, the number of registered boats in the state multiplied just over nine times[1]. The number of fishing licenses sold for the same period increased nearly three times[2]. Expectations are that both will continue to grow at these rates.

Bear Lake Marina

According to surveys done by the Division of Parks and Recreation, 95 percent of those boating at Bear Lake and Hyrum Reservoir were from Utah. The surveys also reveal that, although the number of boats grows steadily, the majority of boaters at Bear Lake and Hyrum reservoirs do not yet consider the lakes overly crowded. They did feel that limits on the number of boats out on the water should be established at Hyrum Reservoir, but not at Bear Lake. Most felt if they were not able to get their boat on the water at their first choice destination, there would still be nearby alternatives[3].

Conflicts have already surfaced between recreational use and traditional agricultural, M&I, and hydropower production. One of the natural results of reservoirs being used at their design limits is that average water levels will be lower, at the end of summer than at the beginning. Boaters at Hyrum Reservoir are concerned with the fluctuating water levels and would like to see the water level maintained at a higher level[3]. Fully utilizing the reservoirs not only reduces useable surface areas but also increases the distance to the water.

Bear Lake's water levels are controlled by the stipulations of the Bear River Compact, the 1995 settlement agreement and contracts between Utah Power and Light (now PacifiCorp) and their contracts with water users in Idaho and Utah. This has been a sore spot with property owners and recreational enthusiasts who desire a more stable lake level. Although the level of the lake fluctuates

as PacifiCorp meets its downstream contracts, efforts have been made in recent years to include the homeowners and recreationists in discussions about operation of the lake.

Recreational water use has long been important in Utah and has been planned into many water projects. Recreational users are becoming more vocal in expressing their wishes. Where possible, it is important to include these users in discussions regarding new water projects or changes in the operation of existing ones. By so doing, and by everyone participating constructively, solutions to the increasingly complex situations now arising can be created.

NOTES

1. Utah Division of Parks and Recreation, State of Utah: Strategic Boating Plan, April 2000

2. Utah Division of Wildlife Resources, license sales records

3. Utah State University Institute for Outdoor Recreation and Tourism and Utah Division of Parks and Recreation: A Summary Report: 2001 Utah State Park Boater Intercept Survey, March 2002